Influence of Scion and Rootstock on Incidence of Peach Tree Short Life

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Abstract

Previous work has suggested that peach scion cultivar exerts a significant influence on incidence of peach tree short life (PTSL) in trees budded onto Nemaguard and Flordaguard seedling peach rootstocks. If this influence is consistent across a range of rootstocks then the influence of scion cultivar might offer a new tool for the management of PTSL. Growers could minimize losses on those sites most prone to PTSL by using the least susceptible scion/rootstock combinations. In this trial trees of 'Agua 6-4,' 'Springcrest,' 'Redglobe,' 'Redhaven' and 'Cresthaven' budded onto Guardian (BY520-9), Lovell, Nemaguard and Siberian C peach seedling rootstocks were planted on a site with a known history of PTSL. After 6 years, 31 % of test trees had succumbed to PTSL and 18% to other causes. Both scion and rootstock exerted a profound influence on incidence of PTSL (P<0.0001). Mean effects of scion cultivar ranged from 10 to 49% PTSL mortality. Mean effects of rootstock treatment ranged from 10 to 85% PTSL mortality. However, a significant scion x rootstock interaction was also present (P<0.05). This appeared to be largely the result of anomalously low or high PTSL incidence observed in 2 scion/rootstock combinations. These results suggest that some caution should be used in extrapolating the rootstock treatment effects determined in a typical PTSL trial budded with a single scion cultivar to their influence beneath other untested scion cultivars.

INTRODUCTION

Peach [*Prunus persica* (L.) Batsch] trees appear to be predisposed to peach tree short life (PTSL) by the ring nematode [*Mesocriconema xenoplax* (Raski) Loof & deGrisse] (Nyczepir et al., 1983). However, the actual cause of death is suspected to be either cold injury or bacterial canker (*Pseudomonas syringae* pv *syringae* van Hall) of the scion (Ritchie et al., 1981). Rootstocks have been identified which either enhance or reduce incidence of PTSL (Okie et al., 1994; Yadava et al., 1989; Dozier et al., 1984). Very little is known about the effect of the scion cultivar on susceptibility of a scion/rootstock combination to PTSL.Most PTSL trials reported to date have tested a range of rootstocks budded with only a single scion cultivar and only occasionally with more (Reighard et al., 1997; Yadava et al., 1989; and Dozier et al., 1984). One recent report (Beckman et al., 1994) utilizing a wide range of scion cultivars budded to Nemaguard seedling rootstock demonstrated a significant scion influence on incidence of PTSL.Another report (Sherman et al., 1994) showed high PTSL variability in peach scion genotypes budded on Flordaguard seedling rootstock.These reports suggest that scion cultivar exerted an influence equal to, if not greater, than that typically attributed to rootstock on incidence of PTSL. If this effect proved to be uniform across a range of rootstocks, then it would offer growers a new tool for managing PTSL, i.e. the use of the most resistant scion cultivars in conjunction with the most resistant rootstocks on severe PTSL sites. The purpose of this trial was to determine the influence of scion and rootstock genotype on susceptibility to PTSL.

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MATERIALS AND METHODS

Trees were planted in a split-plot design with 10 replications. Main plot treatment was thinning intensity, i.e. either left unthinned or all fruit removed ca. 30 days post-bloom. The sub-plot treatment was 20 different scion/rootstock combinations for total of 400 possible single tree plots. The twenty different scion/rootstock combinations were prepared in fumigated nurseries in the summer of 1994.Scion treatments were 'Agua 6-4,' 'Cresthaven,' 'Redglobe,' 'Redhaven' and 'Springcrest' peach cultivars. Rootstock treatments were open-pollinated seedlings of Guardian (BY520-9), Lovell, Nemaguard and Siberian C.

Trees were planted in the Spring of 1995 in central Georgia at the Southeastern Fruit and Tree Nut Research Laboratory (lat. 32° 38'N, long. 83° 46'W) with a spacing of 1.2 x 6.1 m on a site with a previous history of PTSL as demonstrated by several previous peach plantings. Trees were managed minimally but similar to commercial recommendations except that no attempt was made to control soil pH (ca. 4.8 at planting in 1995 and ca. 4.0 at end of experiment in 2001) and trees were fall pruned each year with a mechanical hedger set to remove ca. 50% of the previous season's growth. These latter 2 management practices were intended to encourage incidence of PTSL.Soil type was Faceville fine sandy loam, a clayey, kaolinitic, thermic typic Paleudult.No supplemental irrigation was provided.

Dead and dying trees were inspected each spring (typically late April or early May) to determine the cause of death, i.e. PTSL, Armillaria root rot, or other/unknown cause.Trees were determined to have died from PTSL if they met the following criteria: (1) died suddenly and rapidly in the spring, (2) tissue damage/necrosis in trunk extended only to soil line initially leaving the below ground portion of the tree alive, (3) sour sap odor was present in necrotic tissue and (4) no other credible cause of death was evident.Trees that died from causes other than PTSL were excluded from subsequent analyses resulting in the loss of 69 plots by the conclusion of the experiment. Additionally, not all scion/rootstock combinations were fully replicated at the start of the experiment. Some trees were either not available or died shortly after planting. These plots were replanted the following year with either the intended scion/rootstock combination or another substituted. In either case these trees were excluded from subsequent analyses resulting in the loss of 22 plots (91 all total). Statistical analyses were carried out via GLM (SAS Institute, 1988) although we recognize the limitations of this type of analysis on binomial survival data (0=dead, 1=alive).

RESULTS

After 6 years, 31% of test trees had succumbed to PTSL and 18% to other causes. There was no main plot treatment effect on mortality (data not shown). Both scion and rootstock exerted a profound ($P<0.0001$) effect on PTSL mortality (Table 1). However, there was also a significant ($P<0.05$) scion x rootstock interaction. This interaction appears to be largely driven by anomalously high and low losses of 'Redglobe' on Guardian and Lovell, respectively (Table 2).

DISCUSSION

Results suggest that there may be problems with our typical approach to rootstock testing for susceptibility to PTSL.Most such trials are typically conducted with a single scion cultivar, the assumption being that results can be extrapolated to other scion cultivars. In this study, we encountered a significant interaction between scion cultivar and rootstock that calls into question this simplistic approach. If this interaction is real, the resulting consequences are twofold. The first is the potential unreliability of conclusions based on main effects. The second is a likely increased expense and longer testing period if more complicated designs are needed. For example, if we had been testing rootstock susceptibility to PTSL with just 'Redglobe' as the scion cultivar, we would have been at least suspicious of Guardian's reportedly superior PTSL resistance compared to Lovell.

Results from an earlier study of scion cultivar influence on susceptibility to PTSL (Beckman, 1994) would suggest that the 5 scion cultivars tested in this study might have been expected to separate out in the order of‘Agua 6-4,’ ‘Springcrest,’ ‘Redglobe,’ ‘Cresthaven’ and ‘Redhaven’ (least to most PTSL susceptible). In this trial neither the analyses constrained to a single rootstock nor the rootstock main effects produce this ranking. Moreover, consider the contradictory conclusions that would be formed regarding ‘Redglobe’s’ PTSL susceptibility if one considers only the data from trees on Guardian vs. those on Lovell.In the former ‘Redglobe’ is rated significantly more susceptible than the other four cultivars tested. In the latter there is no difference, yet the trend displayed suggests Redglobe was somewhat more resistant. The consequence for growers becomes apparent when one considers that the two rootstocks most likely to be used on PTSL sites are Guardian and Lovell. For practical purposes less harm is done if trials err in the direction of overstating a treatments susceptibility to PTSL rather than the reverse. Clearly, more work is needed to address this reported interaction.

In conclusion, the anomalous performance of several scion/rootstock combinations, particularly Redglobe/Guardian and Redglobe/Lovell, needs to be revisited to confirm the presence of an interaction. If the interaction found in this study is refuted then this would support continuing PTSL rootstock trials with a single representative scion cultivar, preferably one that is highly susceptible such as ‘Redhaven’ to accelerate tree losses. Similarly trials to assess scion cultivar influence on PTSL could be performed with a highly susceptible rootstock (again to accelerate tree mortality). However, if an interaction is verified then researchers will need to test more scion/rootstock combinations if they hope to reach conclusions with the broadest possible application and reliability.

Literature Cited

Beckman, T.G., Okie, W.R. and Nyczepir, A.P.1994.Influence of scion cultivar on incidence of peach tree short life. Proc. 6th Stone Fruit Decline Workshop. FVSC, Ft. Valley, GA, Oct. 26-28, 1992. p. 45-48.

Dozier, W.A., Knowles, J.W., Carlton, C.C., Rom, R.C., Arrington, E.H., Wehunt, E.J., Yadava, U.L., Doud, S.L., Ritchie, D.F., Clayton, C.N., Zehr, E.I., Gambrell, C.E., Britton, J.A. and Lockwood, D.W.1984.Survival, growth, and yield of peach trees as affected by rootstock. HortScience 19:26-30.

Nyczepir, A.P., Zehr, E.I., Lewis, S.A. and Harshman, D.C.1983. Short life of peach trees induced by *Criconemella xenoplax*. Plant Dis. 67:507-508.

Okie, W.R., Beckman, T.G., Nyczepir, A.P., Reighard, G.L., Newall, W.C., Jr. and Zehr, E.I.1994.BY520-9, A peach rootstock for the southeastern United States that increases scion longevity. HortScience 29:705-706.

Reighard, G.L., Newall, W.C., Jr., Zehr, E.I., Beckman, T.G., Okie, W.R. and Nyczepir, A.P.1997.Field performance of Prunus rootstock cultivars and selections on replant soils in South Carolina.Acta Hort. 451:243-249.

Ritchie, D.F. and Clayton, C.N.1981.Peach tree short life: A complex of interacting factors. Plant Dis. 65:462-469.

SAS Institute, Inc.1996.SAS for Windows, Version 6.12, SAS Institute, Inc., Cary, NC.

Sherman, W.B. and P.C. Andersen.1994.Observations on peach tree short life in the University of Florida breeding program. Proc. Fla. State Hort. Soc. 107:329-331.

Yadava, U.L. and Doud, S.L.1989.Rootstock and scion influence growth productivity, survival, and short life-related performance of peach trees. J. Amer. Soc. Hort. Sci. 114:875-880.

Tables

Table 1. Mean effects of peach scion and seedling rootstock genotype on incidence of PTSL.

Scion Cultivar	PTSL Mortality [1] (%)	Rootstock	PTSL Mortality (%)
Agua 6-5	10 c	Guardian (BY520-9)	10 c
Springcrest	32 b	Lovell	13 c
Redhaven	43 ab	Nemaguard	50 b
Cresthaven	48 a	Siberian C	85 a
Redglobe	49 a		

[1] Mean separation within columns by Duncan's multiple range test, P=0.05.

Table 2. Effects of peach scion cultivar and seedling rootstock genotype on % PTSL mortality.

Rootstock	Scion Cultivar				
	Agua 6-4	Springcrest	Redhaven	Cresthaven	Redglobe
Guardian	0 Bb [1]	0 Cb	5 Cb	10 Cb	33 Ba
Lovell	0 Ba	15 Ca	22 Ca	18 Ca	6 Ba
Nemaguard	10 Bb	53 Ba	52 Ba	60 Ba	67 Aa
Siberian C	36 Ab	83 Aa	94 Aa	100 Aa	94 Aa

[1] Mean separation within columns indicated by upper case letters and mean separation within rows indicated by lower case letters, Duncan's multiple range test, P=0.05.